

# Multi-Use Solar Thermal System for Oxygen Production from Lunar Regolith [7227-060], Phase I

Completed Technology Project (2007 - 2007)



## Project Introduction

Physical Sciences Inc. (PSI), in collaboration with the Lockheed Martin Space Systems Company (LMSSC) and Orbital Technologies Corporation (Orbitec), proposes to develop the multi-use solar thermal system for oxygen production from lunar regolith. In this system solar radiation is collected by the concentrator array which transfers the concentrated solar radiation to the optical waveguide (OW) transmission line made of low loss optical fibers. The OW transmission line directs the solar radiation to the thermal receiver for thermochemical processing of in-situ resources or for manufacturing of materials and components on the planetary surface. Key features of the proposed system are: 1. Highly concentrated solar radiation ( $10^3 \sim 10^4$  suns) can be transmitted via the flexible OW transmission line directly to the thermal receiver for thermochemical or manufacturing; 2. Power scale-up of the system can be achieved by incremental increase of the number of concentrator units; 3. The system can be autonomous, stationary or mobile, and easily transported and deployed on the lunar surface; and 4. The system can be applied to a variety of ISRU processes.

## Anticipated Benefits

Application of the proposed solar power system to other space applications will be possible as its technical maturity progresses. PSI is developing solar thermal rocket system for satellite propulsion under Air Force SBIR funding. The solar thermal rocket system will enable communication satellites to utilize solar power for station keeping and orbit change. For terrestrial applications the proposed system will be used for a small scale, transportable solar heat source for: detoxification of contaminated soil; small power plant using compact heat engine; air conditioning cycle; and industrial process heat. The specific application of the proposed solar power system is for production of oxygen and other useful materials on the lunar surface. The solar thermal system could be set in place prior to the initiation of various lunar projects such as mining, processing or manned outposts. Therefore, the solar thermal system is the key enabling technology for building up the infrastructure for the lunar base. The solar thermal power system to be developed in this program can also be used for electric power conversion using dynamic electric power generator, such as Stirling converter.



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

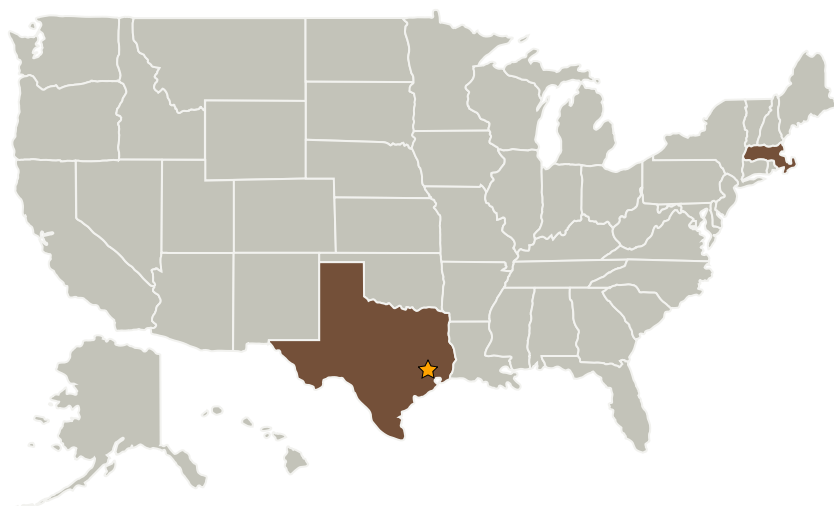
Small Business Innovation Research/Small Business Tech Transfer

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Physical Sciences, Inc.	Supporting Organization	Industry	Andover, Massachusetts

## Primary U.S. Work Locations

Massachusetts	Texas
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## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Project Manager:**

Aaron Paz

**Principal Investigator:**

Takashi Nakamura

## Technology Areas

**Primary:**

- TX13 Ground, Test, and Surface Systems
  - └ TX13.4 Mission Success Technologies
    - └ TX13.4.6 Ground Analogs for Space/Surface Systems